Gravity Practice Sheet #1 KEY

1. $F_G = \frac{GMm}{r^2}$

$G = 6.67 \times 10^{-11}$
$m = 70\,kg$
$M = 2000\,kg$
$r = 1\,m$

$F_G = \frac{(6.67\times10^{-11})(2000\,kg)(70\,kg)}{(1\,m)^2}$

$F_G = 9.34 \times 10^{-6}\,N$

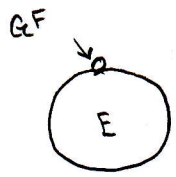
2. $F_G = \frac{GMm}{r^2}$

$G = 6.67 \times 10^{-11}$
$M = .45\,kg$
$m = .45\,kg$
$r = (.08m + .08m) = .16\,m$

$F_G = \frac{(6.67\times10^{-11})(.45\,kg)(.45\,kg)}{(.16\,m)^2}$

$F_G = 5.28 \times 10^{-10}\,N$

3. $F_G = \frac{GMm}{r^2}$



$G = 6.67 \times 10^{-11}$
$M = 5.9742 \times 10^{24}\,kg$
$m = .45\,kg$
$r = 6.3710 \times 10^{6}\,m$

$F_G = \frac{(6.67\times10^{-11})(5.9742\times10^{24}\,kg)(.45\,kg)}{(6.3710\times10^{6}\,m)^2}$

$F_G = 4.42\,N$

4. $F_G = \frac{GMm}{r^2}$

$\left(\frac{r^2}{Gm}\right) F_G = \frac{GMm}{r^2}\left(\frac{r^2}{Gm}\right)$

$M = \frac{r^2 F_G}{Gm}$

$G = 6.67 \times 10^{-11}$
$M = ?$
$m = 90\,kg$
$r = 1.74 \times 10^{6}\,m$
$F_G = 146\,N$

$M = \frac{(1.74\times10^{6}\,m)(146\,N)}{(6.67\times10^{-11})(90\,kg)}$

$M = 7.36 \times 10^{22}\,kg$

$G\frac{m}{r^2} = ?$ $G = 6.67\times10^{-11}$

$M = 5.9742\times10^{24}\ kg\ (M_\oplus)$

$r = 6.378\times10^{6}\ m\ (R_\oplus)$

$$\frac{(6.67\times10^{-11})(5.9742\times10^{24}\ kg)}{(6.378\times10^{6}\ m)^2} = 9.8\ m/s^2$$

a. $9.8\ m/s^2$ b. "little g" accel. due to gravity for Earth

c. $m = M_\oplus$

$r = R_\oplus$

6. $F_G = \frac{GMm}{r^2}$ $G = 6.67\times10^{-11}$

$M = 5.9742\times10^{24}\ kg$

$m = 7.36\times10^{22}\ kg$

$r = 3.84\times10^{8}\ m$

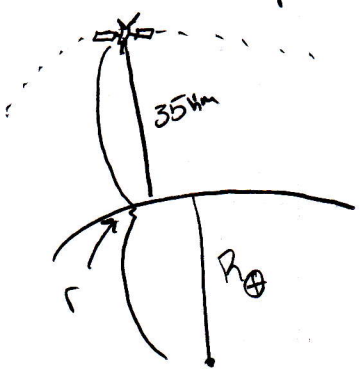
$$F_G = \frac{(6.67\times10^{-11})(5.9742\times10^{24}\ kg)(7.36\times10^{22}\ kg)}{(3.84\times10^{8}\ m)^2}$$

$F_G = 1.99\times10^{20}\ N$

7. $F_G = \frac{GMm}{r^2}$ $G = 6.67\times10^{-11}$

$M = 5.98\times10^{24}\ kg$

$m = 500\ kg$



$r = (3.5\times10^{4}\ m + 6.378\times10^{6}\ m) = 6.3815\times10^{6}\ m$

* not a huge Δ

$$F_G = \frac{(6.67\times10^{-11})(5.98\times10^{24}\ kg)(500\ kg)}{(6.3815\times10^{6}\ m)^2}$$

$F_G = 4.89\times10^{3}\ N$

8. $F_G = \frac{GMm}{r^2}$ $G = 6.67\times10^{-11}$

$M = 1.99\times10^{30}\ kg$

$m = 5.98\times10^{24}\ kg$

$r = 1.50\times10^{11}\ m$

$$F_G = \frac{(6.67\times10^{-11})(1.99\times10^{30}\ kg)(5.98\times10^{24}\ kg)}{(1.50\times10^{11}\ m)^2}$$

$F_G = 3.52\times10^{22}\ N$